

58. A semiconductor apparatus according to claim 41, wherein said second insulating layer includes means for controlling a shape of said second insulating layer.

59. A semiconductor apparatus according to claim 58, wherein said means for controlling a shape of said second insulating layer comprises particles included in the second insulating layer. --

In the Abstract:

Please replace the abstract with the new abstract provided on a separate sheet herewith.

REMARKS

This amendment is a submission under 37 C.F.R. 1.114 for the Request for Continued Examination (RCE) filed in the above-identified matter on even date herewith.

The present amendment is in response to the Final Office Action dated October 16, 2002 in the above-identified application. Entry of the present amendment prior to examination of this RCE is respectfully requested.

By the present amendment, the original claims 20-35 have been cancelled and replaced by new claims 36-59. For the Examiner's convenience, it is noted that claims 36 and 42 contain all limitations of previously submitted claim 20 together with additional limitations while claim 41 includes all limitations of previously submitted claim 29, plus additional limitations.

Reconsideration and allowance of newly submitted independent claims 36 and 42 is respectfully requested. As discussed in the amendment filed on September 13, 2002, with regard to claim 20, newly submitted independent claims 36 and 42 are each directed to an arrangement which can be read, for example, on a structure such as shown in Figs. 27 and 28 of the drawings (noting that this reference to the drawings is solely for purposes of example). In particular, an arrangement is defined in which circuit electrodes are formed centrally on a semiconductor device with a first insulating layer formed on the semiconductor device in such a manner that the circuit electrodes are exposed, a second electrically insulating layer formed on the first insulating layer, external connection terminals formed on the second insulating layer, a wiring formed on the second insulating layer to electrically connect to the external terminals and a third electrically insulating layer formed on the second insulating layer and on the wiring. In particular, in accordance with the language of amended claim 36, the second insulating layer contains particles to control a shape of the second insulating layer. In accordance with the provisions of newly submitted independent claim 42, the second insulating layer contains means for controlling a shape of the second insulating layer. Thus, in each instance, newly submitted claims 36 and 42 define that the second insulating layer contains an element to control the shape of the second insulating layer. It is noted that dependent claim 43 defines that the means for controlling the shape comprises particles.

Reconsideration and allowance of the independent claims 36 and 42 over the cited prior art to Shimoishizaka and Ohashi is respectfully requested. As noted above, both independent claims 36 and 42 are directed to the second insulating layer containing either particles or means for controlling a shape of the second

insulating layer. As recognized in the Office Action, Shimoishizaka fails to teach or suggest any such particles. However, the Office Action goes on to cite Ohashi as teaching particles that can be combined with Shimoishizaka to arrive at the claimed invention. Applicants respectfully submit that it would not be at all obvious to make this combination since adding particles to the insulating layer of Shimoishizaka would actually create harmful effects for the construction of a device in accordance with the teachings of Shimoishizaka, as will be discussed in detail below. In addition, it is respectfully submitted that nothing in either Shimoishizaka or Ohashi would suggest this combination, noting that the location and use of particles in the secondary reference to Ohashi is actually quite different than that of the present invention defined by independent claims 36 and 42.⁴

Turning to Shimoishizaka, it is noted that this reference utilizes photolithography to form an opening in a low elasticity layer 20. In order for photolithography to work successfully in this case, it is necessary for the photosensitive insulating material film to be as flat and uniform as possible to permit successive patterning of the film. Therefore, in Shimoishizaka, the relatively thick photosensitive insulating layer 21 (20) is formed on the entire surface of the wafer and then a low elasticity layer having an opening is formed by photolithography.

Because of the need for maintaining a smooth and uniform layer to successfully use photolithography, the use of particles in Shimoishizaka would cause significant problems for the photolithography process. More specifically, if particles were contained in the insulating material layer, light striking these particles would be undesirably scattered. This would essentially make it virtually impossible to precisely form an inclined portion or a desired opening. Still further, if inclined portions for the insulating layer included particles, it would be essentially impossible

to form a fine pattern for wiring with high precision due to the presence of these particles. Thus, the fact that Shimoishizaka utilizes photolithography leads directly away from the use of particles in the insulating layer being equated to the second insulating layer of claims 36 and 42.

As discussed on page 28, lines 6-15, the present invention utilizes an insulating layer containing particles because techniques other than photolithography are utilized. In particular, the present invention utilizes particles in the second insulating layer to adjust viscosity and thixotropy of, for example, a paste used for the insulating layer. As such, the present claims are directed to a structure which is produced in a significantly different manner than that of Shimoishizaka.

It is respectfully submitted that nothing in Ohashi would lead one to the major modifications of Shimoishizaka which would be necessary to arrive at the claimed invention. With regard to this, it is noted that Ohashi is directed to providing an epoxy resin composition for molding a semiconductor device. The purpose of Ohashi's invention is to provide a semiconductor device sealed with an epoxy resin composition in its cured products which will have good curability, releasability from metal molds, shapability and stability. Therefore, an organic phosphorous compound represented by formula (1) in Ohashi is used as a curing accelerator in the epoxy resin composition. More specifically, by blending an inorganic filler, the semiconductor conductor encapsulating epoxy resin composition has its thermal expansion coefficient reduced, thereby lowering stress.

In the present independent claims 36 and 42, a second insulating film is defined on which a third insulating film is formed. Thus, the particles in the second insulating film do not correspond to particles provided in an encapsulating resin such as Ohashi. Thus, although Ohashi may be of general interests for the concept of

providing particles in an encapsulating epoxy resin composition, there is nothing in Ohashi which would motivate one to provide particles in a second insulating film, covered by a third insulating film, for purposes of shaping the second insulating film, as defined in the independent claims 36 and 42. Therefore, it is respectfully submitted that nothing in Ohashi would teach or suggest the complete modification of Shimoishizaka which would be necessary to arrive at the claimed invention, noting that Shimoishizaka utilizes photolithography which would lead one directly away from use of particles for its insulating layers. Accordingly, consideration and allowance of newly submitted independent claims 36 and 42 over the combination of Shimoishizaka and Ohashi is respectfully requested.

Reconsideration and allowance of the dependent claims 37-40, 43-48, 49, 50, 54 and 55 is also respectfully requested. These claims define numerous features, in combination with either claim 36 or 42, which are neither taught nor suggested by the cited references to Shimoishizaka and Ohashi. These include the features that the second insulating film is a stress relaxation layer to relieve stress between the semiconductor device and the board on which the apparatus is mounted, the limitation that the particles are made of the same material as the second insulating film, the limitation that the particles are an inorganic material, or the specifics of the particles, the thickness of the second insulating layer, and the limitation that the second insulating layer is a printed layer of an insulating material containing particles formed by the use of a print mask. As such, these limitations clearly define over the photolithographically formed structure of Shimoishizaka, whether considered alone or in combination with Ohashi. Therefore, consideration and allowance of these newly submitted dependent claims is also respectfully requested.

Reconsideration and allowance of the newly submitted independent claims 36

and 42, and their dependent claims, over the combination of Shimoishizaka and Hembree is also respectfully requested.

As noted above, the use of particles or means for controlling the shape of the second insulating layer is completely unsuggested by the primary reference to Shimoishizaka and is, in fact, completely contrary to the photolithographic techniques used in Shimoishizaka. It is respectfully submitted that nothing in Hembree would lead one to the complete modification of Shimoishizaka which would be necessary to meet the terms of independent claims 36 and 42 and their dependent claims. Hembree teaches a spring element for use in an apparatus (such as a bonding element for a semiconductor module), and is not concerned with providing particles in insulating layer in a semiconductor device between two other insulating layers. More specifically, Hembree fails to teach or suggest anything regarding a stress relaxation layer for a semiconductor device between two other insulating layers. Therefore, although Hembree may be of general interest, nothing in the reference would lead one to completely modify Shimoishizaka to arrive at these claimed structures. Therefore, reconsideration and allowance of independent claims 36 and 42, and their dependent claims, over the combination of Shimoishizaka and Hembree is earnestly solicited.

Reconsideration and allowance of independent claim 41 (containing the limitations of previously submitted claim 29) over Shimoishizaka and Ohashi is also respectfully requested. New claim 41 has been amended to further define that the third insulating film in the semiconductor device covers not only an upper surface and a side surface of the second insulating layer, but also the side surface of the first insulating layer. It is respectfully submitted that this amendment serves to further distinguish over the structure of Shimoishizaka, whether considered alone or in

combination with Ohashi.

References again made to Figs. 27 and 28 with regard to the claimed structure set forth in claim 21.

More specifically, in conventional semiconductor packages having resin sealing or encapsulation, since the circuit electrodes, wiring conductors and insulating layers are not exposed to the external atmosphere, absorption of moisture into an insulating layer from the outer atmosphere ordinarily does not occur. Therefore, the problem of peeling or separation of a film in such conventional structures is not a significant problem.

On the other hand, an arrangement such as shown by Shimoishizaka, the wafer is not in a sealed state, even though a passivation film 12 covers a low elasticity layer 20. In particular, in the arrangement of Shimoishizaka, the side surfaces of the films are exposed. Therefore, the side surface of the passivation film can absorb moisture, which can lead to a significant problem of peeling or film separation. Therefore, the arrangement set forth in claim 41 in which the side surfaces of both the first and second insulating layers are covered by the third insulating layer, except where external connection terminals and wirings are connected to each other, represents a significant improvement over the unprotected arrangement of Shimoishizaka. In addition, nothing in Ohashi suggests modification of the structure of Shimoishizaka to arrive at these claimed features. Therefore, reconsideration and allowance of newly submitted claim 41, and its dependent claims, over Shimoishizaka and Ohashi is earnestly solicited.

In addition to the above discussed amendments to the claims, applicants have amended the abstract to provide a new abstract herewith, in response to paragraph 1 of the Office Action, and have made the appropriate amendments to overcome the

claim objections set forth in paragraph 2 of the Office Action. Therefore, removal of these objections is respectfully requested.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of, either by telephone discussion or by personal interview, the Examiner is invited to contact applicants' undersigned attorney at the number indicated below.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, Deposit Account No. 01-2135 (500.39240X00).

Respectfully submitted,

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